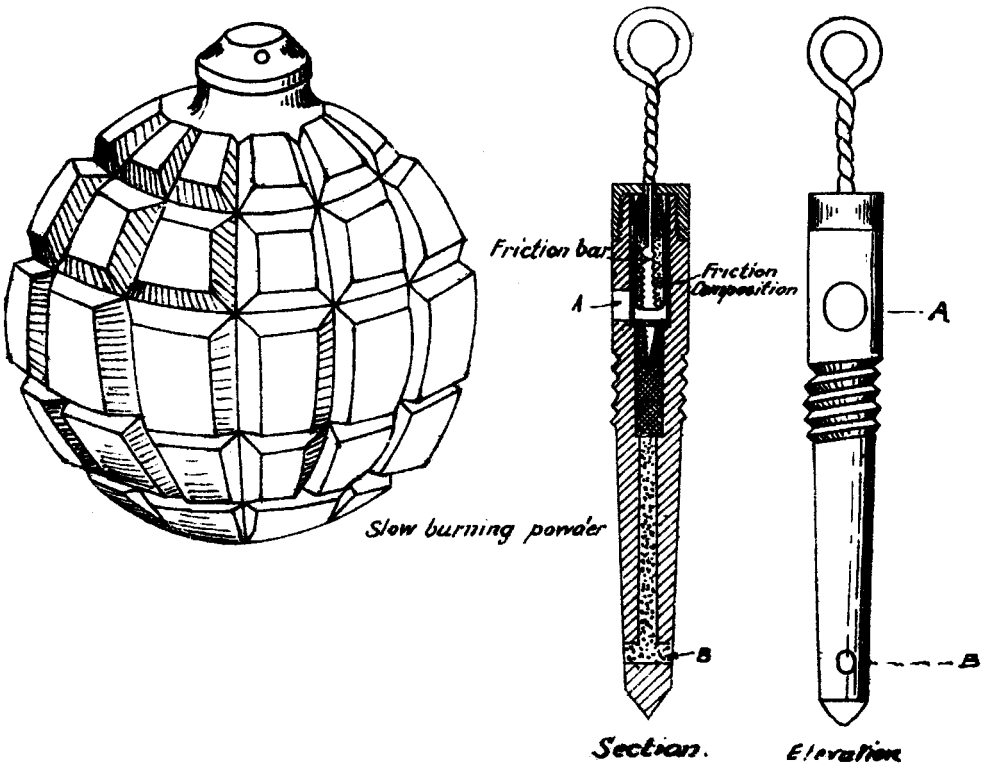
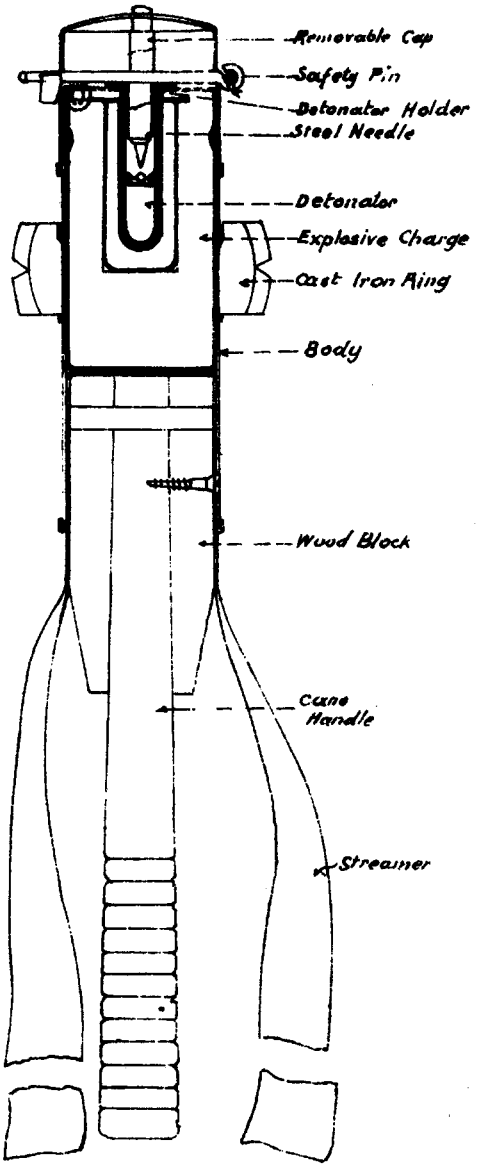
CHAPTER I

Jam-Tins, Pitchers and Balls – Hand Grenades 1914–15

The Russo-Japanese War made a much greater impression on the German observers than it did on those of Britain or France. This was not because the Germans were more receptive to new ideas than the British or the French but because the German Army had a somewhat different perspective. For one thing, it saw a future war as one of conquest, in which it might go east into Russia or west into France (in fact, it did both). Irrespective of which way it chose to go, a series of border forts would have to be destroyed if an invasion was to succeed. The siege of Port Arthur, which brought grenades and trench mortars to the fore, suggested to the Germans that similar situations its army might face when it invaded its neighbours could be resolved effectively with similar weapons. Consequently, the German



The German ball grenade was about 3 inches in diameter and varnished. The cast iron was about ⅛ inch thick. Explosive was black powder. The friction igniter of this example was fired by pulling the wire using a wrist strap with a swivel hook. (The Training and Employment of Grenadiers)



No. 1 Mk III percussion hand grenade. The handle of the No. 1 Mk I was much longer than this. (The Training and Employment of Grenadiers)

Army adopted heavy siege mortars and these later proved their effectiveness as they were responsible for the destruction of the Belgian forts at Namur and Liège in 1914. The German Army also saw the potential of hand and rifle grenades as well as lighter trench mortars, and decided to equip its army with them. It entered the First World War well supplied with grenades and, although the number of trench mortars available at the start of the war subsequently proved inadequate, they were nevertheless much better equipped than either the British or French Armies.

The start of trench warfare in late September to early October 1914 presented the British Army with a series of problems that could not be resolved quickly. In fact, it took until about the spring of 1916 to get on top of them. At the heart of these problems was the sudden and desperate need for trench mortars and hand and rifle grenades, a need that grew more pressing with each passing week. Although the British Army had adopted a percussion hand grenade in July 1908, the supply of them was quite inadequate to meet the demands received by the War Office from the increasingly desperate BEF. Moreover, the No. 1 percussion grenade had not been designed with trench warfare in mind and it was causing problems in the field.

Devised by the Royal Laboratory, the No. 1 stemmed from the report on the Japanese hand grenade by Lieutenant-General Sir J.L. Haldane, Britain's representative at the Japanese headquarters in Manchuria, and examples that he brought back to Britain on his return. In appearance, the No. 1 resembled a medieval mace with its 16 in wooden handle topped by a brass cylinder, around which was a segmented double ring of cast iron. Its overall length was just short of 22 in and it weighed nearly 1.75 lb. The cylinder contained the explosive. It had a removable cap to which a firing pin was fixed and held in a safe position by a removable safety pin. Until the grenade was required for use, the detonator was kept separate from the grenade. To arm it, the cap was removed, the detonator inserted and the cap replaced. All that was then required was removal of the safety pin and it was ready. A yard of webbing was wound around and attached to the lower part of

the handle. Its purpose was to stabilize the grenade in flight by streaming out behind it as a tail, ensuring that the grenade landed on its head. It needed to do this to activate the impact fuse. The grenade needed to be handled with extreme care once it was armed.

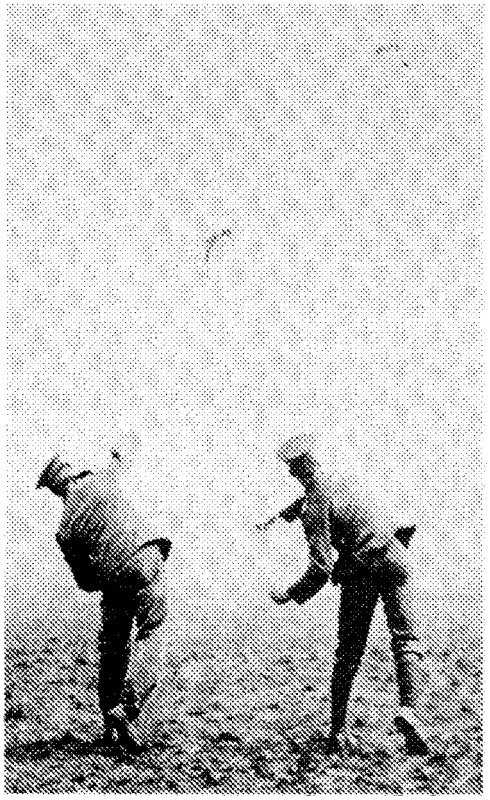
Herein lay its most serious drawback: the percussion fuse was inherently dangerous. The No. 1 was prone to accidents once it had been armed. An impact with any surface would cause it to explode, as was witnessed by Robert Graves in early 1916 when he was an instructor at the base camp at Harfleur. While waiting for the bombing instructor to arrive, a group of soldiers about to be given a grenade demonstration watched as one of their number, a sergeant in the Royal Irish Rifles, picked up a No. 1 from the selection laid out on a table and proceeded to give an impromptu lesson. 'Now, lads, you've got to be careful here! Remember that if you touch anything while you're swinging this chap, it'll go off.' He then hit the edge of the table with it to emphasize the point. The result of this foolish act of bravado was predictable. The grenade exploded, killing the sergeant and a man standing beside him, and severely wounding twelve others.

But surfaces likely to detonate the grenade also included less avoidable things than the edges of tables. During late 1914 and well into 1915 there were numerous accidents caused by the thrower hitting the wall of a trench with the armed grenade while in the act of throwing. Unfortunately, this was all too easy to do because of its length, no matter how careful its users were, especially in the heat of the moment. One solution was to shorten the handle to half its original length but although this reduced the number of accidents it did not eliminate them, because it did not address the fundamental problem – the hazardous nature of the percussion fuse.

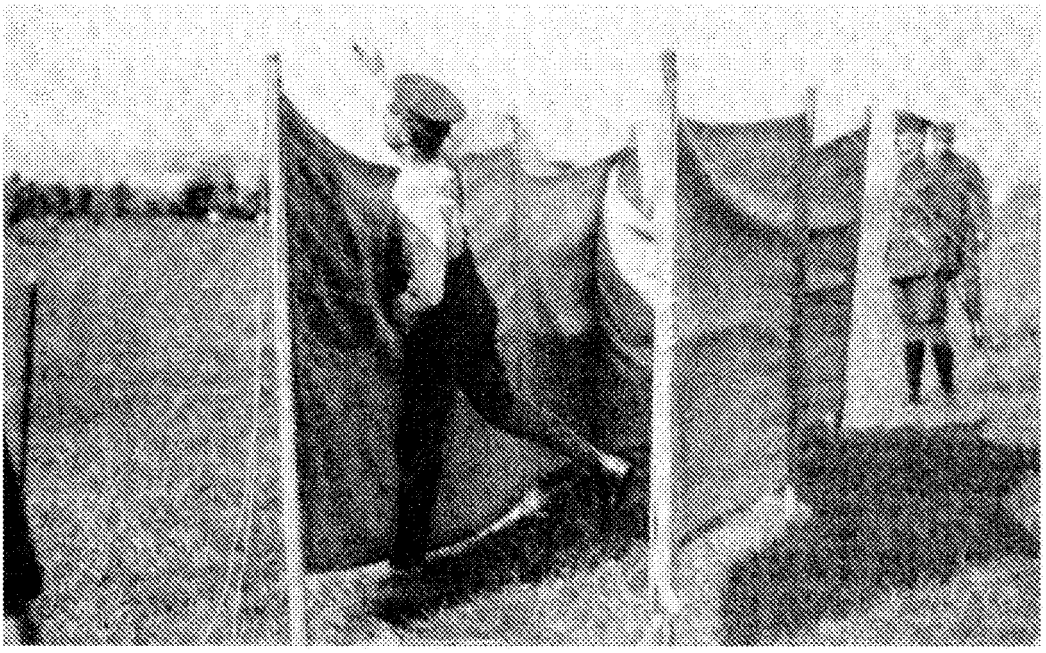
Part of the problem was lack of care by inadequately trained personnel. It had been assumed in 1908 that grenades would be used by trained specialists, Royal Engineers, familiar with handling explosives. In the reality of the trenches, however, they were handled by a far wider range of soldiery who tended to be much less aware of the potential hazards and have much less respect for them until taught otherwise by unfortunate example, as demonstrated by the Royal Irish sergeant at Harfleur. Systematic training did not really get under way until the middle of 1915. Before then, selected officers were given a brief period of instruction on a bombing course and were then expected to pass on their knowledge to others in the battalion. The Second Battalion of the Royal Welch Fusiliers received a demonstration from Second Lieutenant Murphy in January 1915 just after he attended such a course:

> the bomb was a Hale's long-handled stick-grenade [No. 2 hand grenade]. Murphy explained it with characteristic gravity and precision to a somewhat impatient, if not frivolous, audience. He showed us the use of the tail of tape to make it fall on its detonator, withdrew the safety-pin with due solemnity, and then, informing us that the proper action of throwing was that of bowling a cricket-ball, with a good round-arm action he bowled it across into the plough on the other side of the road. The explosion was not very startling, nor the displacement of soil considerable. We trooped across to look at its effect. Someone did say that it might be useful in trench-to-trench fighting.

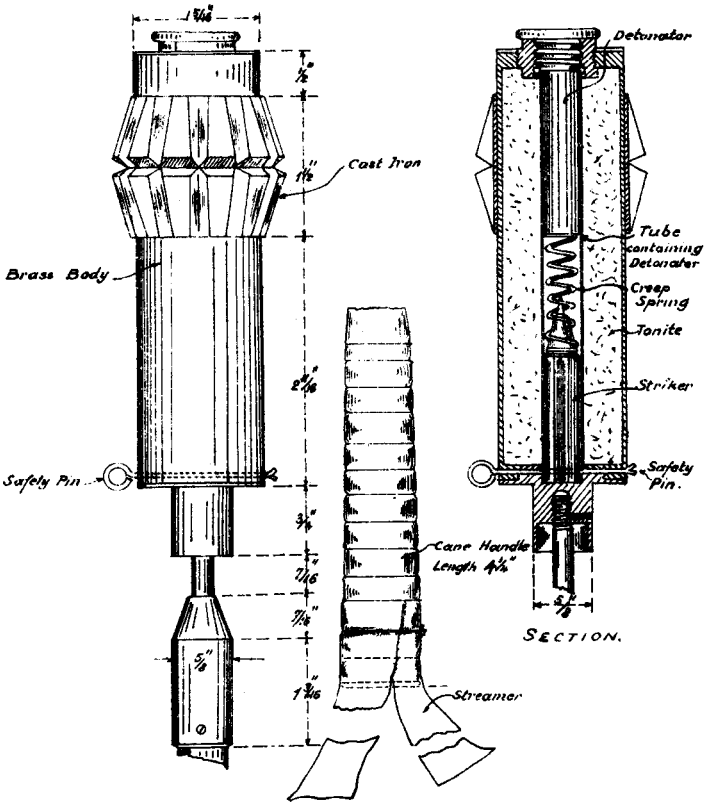
Clearly, the audience was not impressed. When it came to using one in earnest, the erstwhile bomber might never have thrown one before, in which case he had to rely on remembering what he had seen someone else demonstrate behind the lines. Captain Attwater, another Royal Welch officer, recalled Murphy's demonstration when he found himself in a situation in which he had to throw a bomb on the spur of the moment, never having thrown one before. Fortunately, he was not in a trench and he got it right.



Left: *Throwing percussion grenades at a Bombing School, c. 1915. You can just make out the streamers. Note the bowling action of the man on the left.* (ILN)
Below: *Although this photograph from* The Training and Employment of Grenadiers, *issued by GHQ in October 1915, is not very clear, it demonstrates how the percussion stick grenade should be thrown from a trench to avoid hitting the trench wall. The head of the grenade is held rather than the stick part and it is thrown like a dart. This was not the most efficient way of delivering a grenade but at least it was safe.*



A grenade-throwing contest. In view of the screen and unconcerned officer on the right, they are probably practice grenades without explosive. (ILN)



No. 2 percussion grenade. The detonator for this grenade was very similar to that used in the No. 3 rifle grenade, which sometimes caused confusion. It was an extremely sensitive grenade and not popular.
(The Training and Employment of Grenadiers)

The bowling action was the standard way to toss all forms of hand grenade throughout the war. In time, bombers were taught how to do this from kneeling and prone positions as well as standing up. The grenade went further when bowled than when thrown. Moreover because bowling imparted a high-angle trajectory to the bomb, it helped to ensure that the bomb dropped onto the target trench rather than hitting the parapet. Bowling also had the added advantage of getting the bomb clear of the grenadier's own trench; throwing imparted a low-angle trajectory, which tended to result in disaster because the bomb often hit the side before it cleared the trench. Such an incident occurred during the Battle of Arras in 1917 when the Royal Welch Fusiliers were holding a captured German trench. During an exchange of grenades, a Royal Welch grenade failed to clear the trench, hit the top, dropped back into it and 'blew into fragments the feet of a young private'.

There were other problems with the grenade, or more specifically with supplies of the detonator – a problem that persisted throughout 1915 and which was the main cause of delays in production and ultimately of supply to the BEF. By October 1915 the grenade was being produced by the Ordnance Factories at the rate of 8,000 a week but this was far short of the 63,000 a week demanded by Field Marshal French in August. The limiting factor was the rate at which detonators could be made. Orders for 570,000 grenades were placed with various

firms, 'the trade', most of which were unaccustomed to making armaments. In any case, they would be supplied without detonators. Since only the Ordnance Factories had facilities to make the detonators, the trade orders could not significantly improve the supply problem.

If the rate of production of detonators could be increased, the rate of production of completed grenades could be increased. Before the war, there were no more than eight or nine sources of detonators and half of them were German companies without production facilities in Britain. It was also discovered that if commercial companies undertook the manufacture of grenade detonators, this would compete with production of detonators for coal and gold mining, both important to the war effort. Of the commercial companies capable of making the detonators, only Nobel had the capacity to produce large numbers, but it too had problems. It could only make the required number if it stopped making commercial detonators; and the grenade detonators could only be made at one-tenth the rate of commercial detonator production. The situation was further complicated by the fact that the demand for hand grenade detonators competed with the demand for detonators for rifle grenades, which were also percussion-fused.

In September 1915 Nobel's weekly production of detonators for percussion grenades was only 5,000. By October Nobel had been prevailed upon to sacrifice the production of commercial detonators so that it could produce 20,000 grenade detonators a week but most of these were intended for rifle grenades, the need for which had become more pressing than for percussion hand grenades by the middle of 1915 – the demand for hand grenades had been satisfied by other means. In the meantime, Kynoch, the ammunition manufacturer, began the installation of plant to make 40,000 detonators a week but it was not expected to start production before January 1916. Again, most of these were destined for rifle grenades.

The Trench Warfare Department began experimenting with commercial detonators to find an alternative to the 'special' one needed for the percussion grenades as soon as the department was set up in June 1915. The problem was to find a detonator that would ignite the explosive in the grenade which was not the same as the commercial explosives used in mining; it was the explosive that determined the composition of the detonator charge. The trade argued that its commercial detonators would be unsuitable for grenades but it was not as familiar with military explosives as it was with commercial explosives and Trench Warfare Department experiments showed that some commercial detonators would do the job. While these experiments were under way, the department also looked into the possibilities of getting detonators from America but nothing seems to have come of it.

The Trench Warfare Department eventually designed an alternative percussion grenade, the No. 19, with a different detonator but this was not officially adopted until June 1917, although it had seen trials at the front some time before this. Although still a stick grenade, it was quite different from the No. 1. It had a segmented cast-iron pear-shaped body with a stubby extension on the top containing the striker which was topped by a disc, like a very large drawing pin. The Trench Warfare Department was confident that once this grenade went into production, 50,000 a week could be made. Meanwhile, the Royal Laboratory modified the No. 1 Mk III, which had a short handle, to take a different detonator and this was introduced as the No. 18 at the same time as the No. 19.

The British percussion grenades were, it seems, ineffectual. According to reports from German prisoners, captured by the French at Ypres during 1–15 January 1916, the British percussion grenades were deflected by the Germans with the distinctly unsophisticated means of wooden boards set up specifically for the purpose. They even caught some of them in flight and threw them back. The German grenades, on the other hand, were provided with touch cords and were consequently more effective.

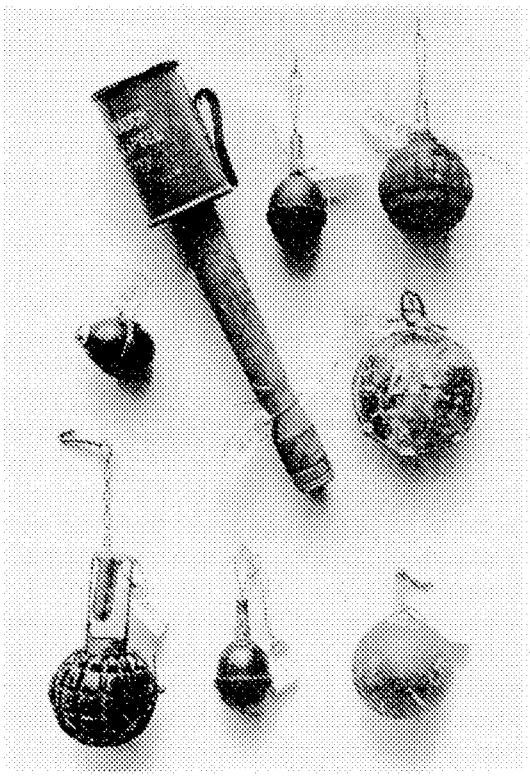
The intense demand for hand grenades led to various short-term solutions, some of which introduced new problems or worsened existing ones. The initial response to the demand was to look for an existing supply of grenades that could be made immediately available to the Army. Such a supply was found. In August 1914 the Cotton Powder Company had been making grenades with percussion fuses under a contract for the Mexican government (Mexico had been going through a period of violent revolution since 1911). The company was making both hand and rifle versions of a grenade that was based on a design by Frederick Marten Hale, an engineer and General Manager of Explosive Trades Ltd (later taken over by Nobel), who patented his grenade in 1911 (UK patent 4,925/11 referred to rifle grenades but the mechanism was just as applicable to hand grenades). On 16 February 1915 this officially became the No. 2 hand grenade but it was also known as the Mexican pattern and the Hale's.

It was very similar to the No. 1. Both had long wooden handles with streamers to ensure that they landed head first. Both had cylindrical brass bodies. Both had segmented rings of cast iron for fragmentation (in the case of the No. 2 it was barrel-shaped as opposed to the thick disc on the No. 1). And both were percussion grenades. Unfortunately, the No. 2 also suffered from the same drawback as the No. 1 in that it required a special detonator that was slow to make. As with the No. 1, there were accidents because of the length of the handle so a shorter-handled version had to be produced.

In October 1915 the Cotton Powder Company was producing the No. 2 at the rate of 5,000 a week but this was about to be increased to 20,000 a week. To further increase output of the No. 2, Roburite & Ammonal began production in 1915 but whereas the Cotton Powder Company made its own detonators, Roburite & Ammonal had to get them from Nobel, which caused delays because Nobel was reluctant to supply them. Although on the face of it, the production of the No. 2 should have increased the supply of grenades to the BEF; in reality it did little to help the situation because of the difficult detonator. Indeed, this may have made the supply problem worse because of the increased competition for the 'special' detonators.

An alternative way of increasing the rate of production of the No. 2 was to change the explosive it contained so that a simpler detonator that was quicker to make could be employed; this appears to have been done. The Trench Warfare Department suggested that the explosive Tonite could be used and the Cotton Powder Company agreed that this would make a simpler detonator a feasible proposition. Meanwhile, the department put pressure on the company to modify its factory to increase its output of detonators and continued to exert pressure on it to ensure that the company fulfilled its promises.

Although there was a huge demand for grenades, paradoxically their real value was not appreciated before the middle of 1915. This was partly because the shortage of grenades at battalion level meant that few men had much experience of them. Even after nearly twelve months of trench warfare some officers remained sceptical of their value but again this stemmed from inexperience rather than outright prejudice. The situation was not improved when unfamiliar grenades were supplied to a battalion whose bombers were trained in the use of some other type. By the time of the Battle of Loos in September 1915 there were twelve different patterns of hand grenade. According to James Jack of the Cameronians, writing in October 1915 (when he was a captain), 'few had mastered completely the mechanism of all of them'. Come to that, few had even seen all of them. Lieutenant-Colonel O.F. Brothers, the Acting Controller of the Trench Warfare Department in August 1919, writing of the hand grenade in a report entitled 'Development of Weapons used in Trench Warfare', noted that 'the development of a war store is never likely to be rapid, unless its value is recognised and practical experience in its use is available'. Before the Battle of Loos 'the Grenade was

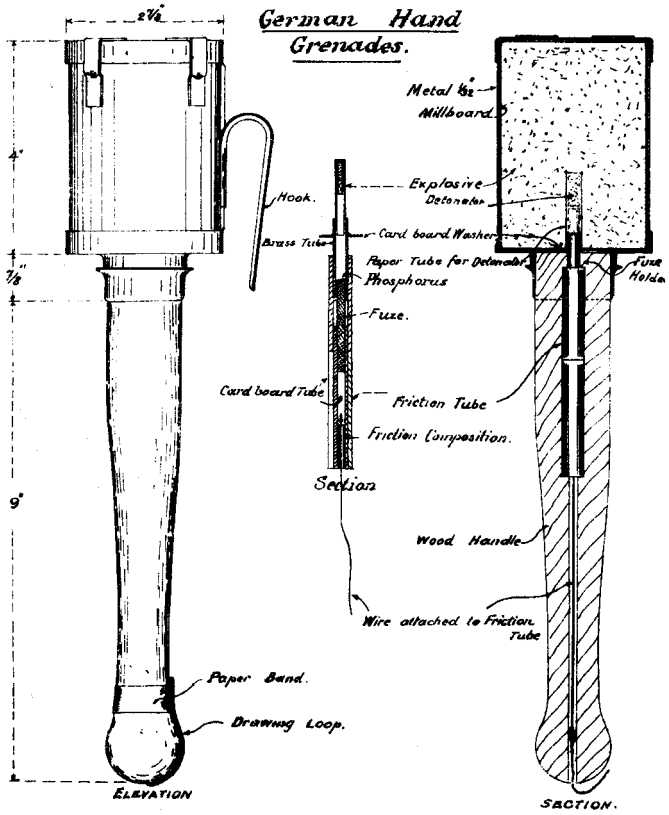


German grenades. Note the belt hook on the stick grenade. The smallest are egg grenades. A Diskusgranate *is in the middle on the right and a* Kugelgranate *(ball grenade) is at the lower left-hand side. It has a throwing handle which pulled the friction igniter as it was thrown.* (IWM)

A German grenadier late in the war. Note the 'special' at his feet, which has the cylinders of six stick grenades attached to the cylinder of a seventh complete with handle. This was probably intended for dealing with strong points or dugouts. Note also the instructions on the cylinders and the fuse type printed on the handles of those hooked on his belt. (The Times History of the War)

considered a "side-show"' and very little research was carried out. The main expenditure of energy was on providing expedient solutions to immediate problems and this was the main reason why there were so many different patterns of hand grenade. By the spring of 1916 most of the twelve had been withdrawn from service because they suffered from serious deficiencies. As Brothers ruefully pointed out in 1919 'The development of Grenades during this war has been on somewhat different lines to the normal lines of development of war stores'.

As soon as the German dominance in grenades and trench mortars became apparent in late 1914, Sir John French requested that someone be put in charge of developing equivalent British weapons as a countermeasure. The man chosen was Colonel Louis Jackson, the Assistant Director of Fortifications and Works (because trench warfare was a form of siege, it came under the remit of Fortifications), and it became his job to come up with equipment suitable for trench warfare. He was a good choice. Jackson could spot a good idea with potential. He was resourceful and inventive while at the same time a capable organizer. Under his direction, the search for new weapons quickly began to bear fruit.



The 1915 German stick grenade, also known as the cylindrical grenade. The lid of the tin cylinder was held in place by four clips. Vor Gebrauch Sprengkapsel Einsetzen *was printed on the outside of the cylinder instructing the user to insert the detonator before use. The paper band at the base of the handle held the pull wire by which the friction igniter was fired. The fuse burning time of 5½ or 7 seconds was marked on the handle.* (The Training and Employment of Grenadiers)

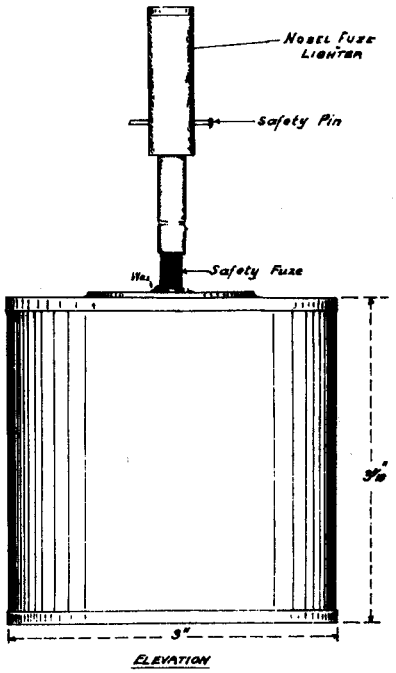
Jackson had been trained at the Royal Military Academy, Woolwich, and had served overseas for much of his career, starting in Afghanistan in 1879. From 1895 to 1902 he was an instructor in fortifications and military engineering at the School of Military Engineering, Chatham, and from 1907 to 1910 he was the Assistant Director of Fortifications and Works before becoming the Chief Engineer of the London District in 1910. He retired from the Army in 1913. On the outbreak of war in August 1914 he was reappointed as an assistant director at the War Office. In 1915 he became a director-general in the Ministry of Munitions and between 1916 and 1917 he was Controller of Trench Warfare Research. He was to play an important role in the development of new weapons for trench warfare.

Jackson was responsible for the introduction of several of the hand grenades in service in 1915, as well as for helping to improve on others of the twelve. Each of them was a stopgap measure designed to provide a quick and ready supply of grenades that were easy to make in large numbers. They all dispensed with the percussion fuse, partly because of its inherent dangers and partly because of the problems that already existed in supplying suitable detonators. The time fuse that these reintroduced (all grenades prior to the twentieth century had used time fuses) remained the standard type used in hand grenades throughout the war, although the nature and operation of the fuse became more sophisticated. Later in the war attempts were made to reintroduce percussion-fused hand grenades but by then the time fuse was master.

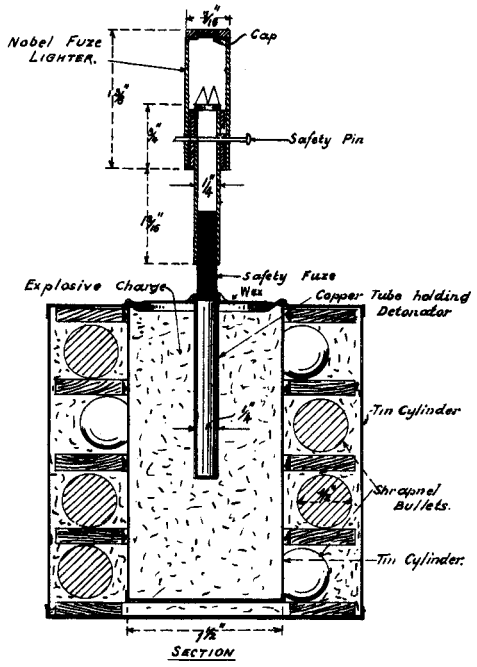
Two of the grenades that owed their existence to Jackson have become synonymous with the spirit of improvisation at the front – the Jam-Tin and the Hairbrush grenades. It is clear from Jackson's account about early research that the Jam-Tin, or jam-pot, and the Hairbrush were his inventions, rather than unofficial improvisations created in France that were subsequently adopted on an official basis and manufactured under contract in Britain. The genesis of both had been a discussion with Lieutenant-General Sir Stanley von Donop, the Master-General of Ordnance, about the problem of supplying enough grenades. Jackson volunteered that he could 'make some' and was promptly given the opportunity to prove it.

Jackson obtained information from France about the quantity and type of explosive that would be likely to give the best results and set about designing hand grenades. In the end, his two designs contained ammonal. The idea for the Jam-Tin came from his knowledge of the 'quick manufacture of tin' through his earlier dealings with the Ammonal Company, which subsequently became the main contractor for both the Jam-Tin and the Hairbrush grenades. The Jam-Tin was officially known as the Double Cylinder grenade and it came in two versions. For some reason, rather than giving them Mk I and Mk II designations they were assigned different series numbers, so were born the No. 8 and No. 9 patterns. The difference between them was slight and amounted to little more than the No. 9 being heavier than the No. 8 by about 7 oz. Not surprisingly perhaps, the No. 8 was known as the Light Pattern and the No. 9 as the Heavy Pattern.

A group from the 2nd Battalion, Argyll and Sutherland Highlanders, spring 1915. Several grenades are on show including examples of the No. 2 and the Jam-Tin. (IWM)



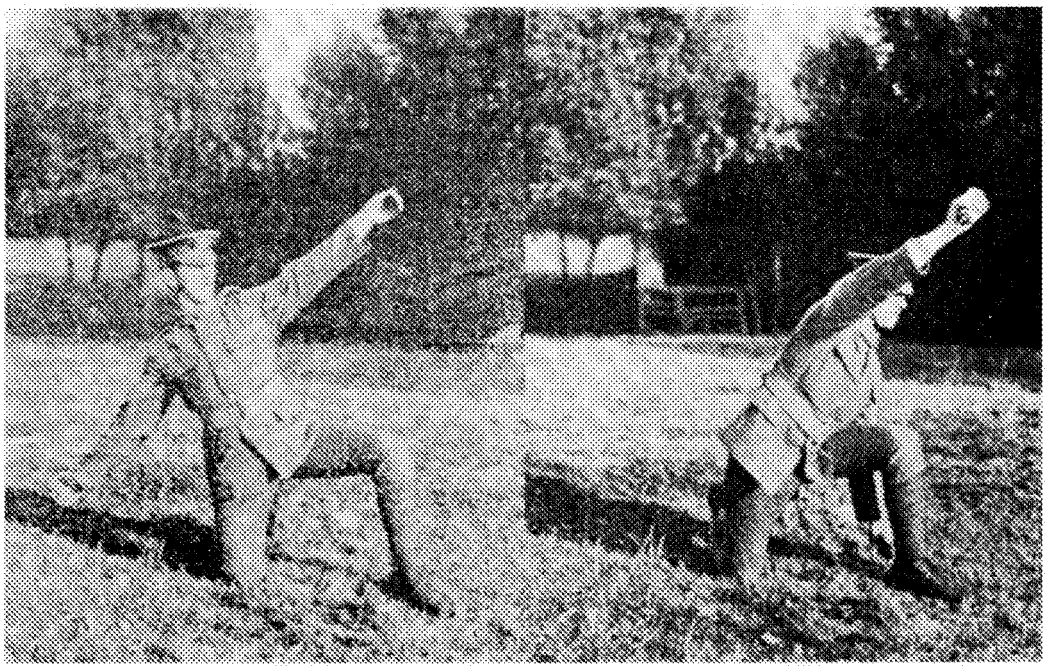
The Jam-Tin grenade with Nobel igniter. (The Training and Employment of Grenadiers)



The Jam-Tin (No. 8) in section showing the shrapnel bullets and cast iron rings. The explosive was ammonal. (The Training and Employment of Grenadiers)

The Jam-Tin grenade was basically two cylinders or tubs of soldered tin, one inside the other, with 0.5 in steel shrapnel balls set in resin between them, the smaller, inner tub being filled with explosive, with a copper detonator holder in the centre of it to take a No. 8 Mk VII detonator (a development of commercial detonators). When the detonator was inserted immediately prior to use of the grenade, two lengths of copper wire, attached to the grenade's upper lid of tin, were used to secure it in place. The shrapnel filling was similar to that used in artillery shells. The No. 8 contained circular spacers of wood about 0.5 in thick, one at the top (the tops of the two tubs were both soldered to the upper lid) and one at the bottom of the outer casing, whereas the No. 9 dispensed with them and incorporated more shrapnel balls instead. It was these extra balls that made the grenade heavier (it weighed 2 lb as opposed to 1.5 lb). The heavier No. 9 was intended to be thrown by catapults and bomb-throwers as well as by hand, the extra weight allowing it to travel further than the lighter version.

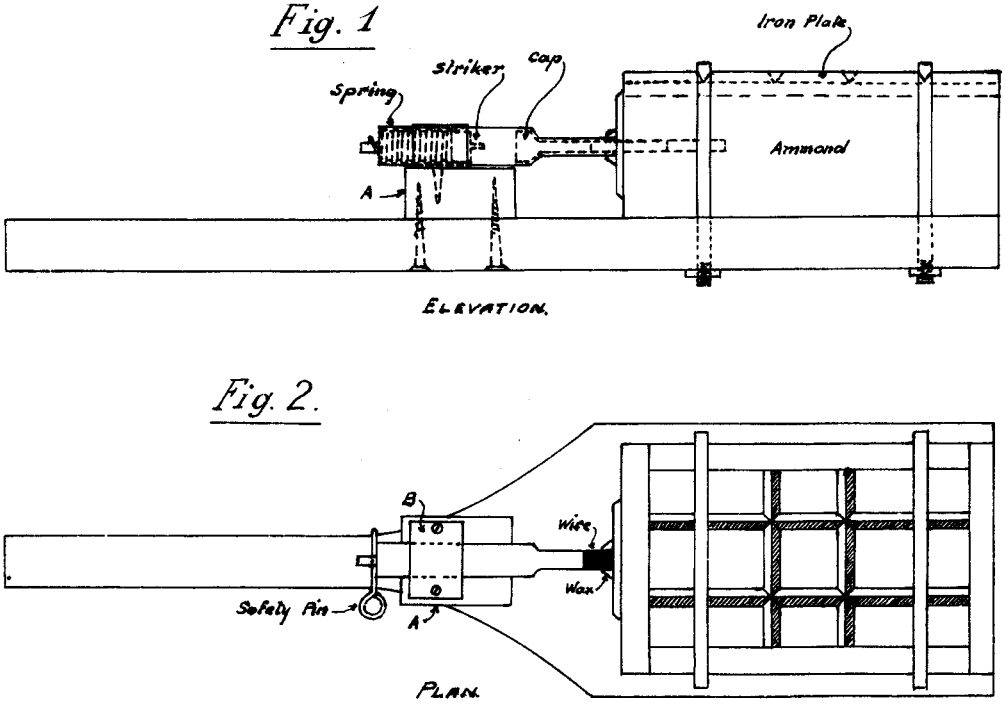
Fusing for both grenades was extremely rudimentary but functional. Initially, Jackson tried Bickford fuse but trials showed it to be unsuited to the trench conditions; if it got damp it would not light. Bryant & May, Brock and others designed various fuses for the grenades to get round this problem. Brock produced a matchhead that was rubbed on an arm brassard to ignite it. When Bickford fuse was used, a portfire was intended as the means of ignition but in practice burning cigarettes were more often used, as recounted by Captain Hitchcock of the 2nd Battalion, Leinster Regiment. During an incident at Hooge in 1915 'Algeo [another officer] and his half-dozen bombers did wonders. With cigarettes in their mouths for lighting the fuses of their jam-tin bombs, they drove back over thirty Huns armed with Krupp's latest pattern bomb.'



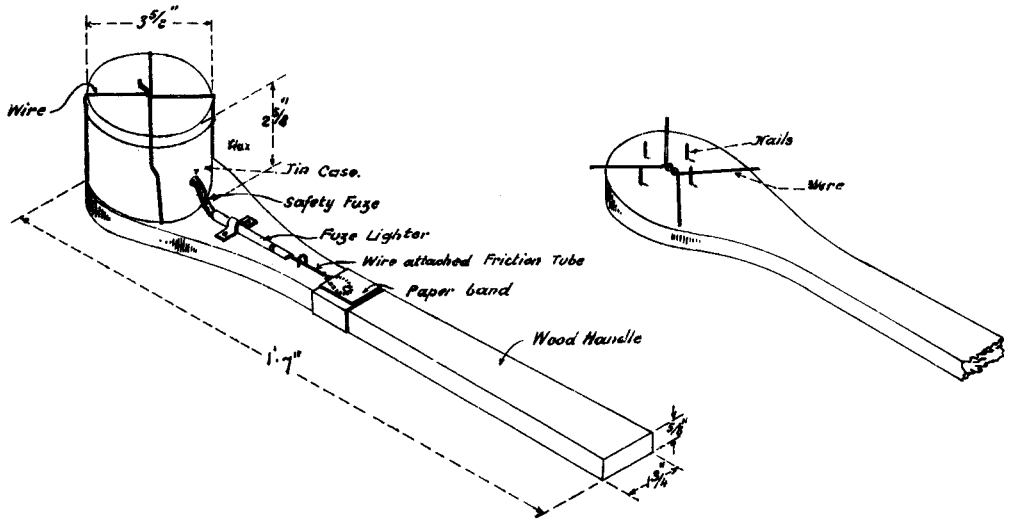
Throwing a grenade from the kneeling position, demonstrating the bowling action. It is not easy to see which grenade the soldier is holding but it appears to be a No. 6, No. 7 or Jam-Tin. The range was expected to be a minimum of 20 yd from this position when in the open. In 1915, it was suggested that those men who enjoyed outdoor games would make the best bombers, especially if they were tall – the taller the man, the longer his reach and the further he could toss the grenade. (The Training and Employment of Grenadiers)

The Jam-Tin bomb was simple to extemporize by Royal Engineers who were encouraged to improvise from late 1914 onwards and throughout 1915. It is not clear whether the bomb acquired its name because it resembled a jam tin or because empty jam tins were used to make the grenade at the Front. There is no doubt that it was improvised from empty jam tins in France as well as in the Dardanelles, where grenades of any kind were in very short supply. Under such circumstances, the tins were filled with scrap metal of all kinds including cut lengths of barbed wire. The explosive filling was usually gun cotton and the fusing was usually Bickford safety fuse. The book *The War the Infantry Knew* suggests that improvised Jam-Tin bombs appeared in December 1914 but a 'demonstration with a new kind of bomb, a tin canister said to contain an almost unbelievable number of shrapnel bullets' carried out by Second Lieutenant Murphy in March 1915 seems more chronologically accurate and clearly refers to the No. 8 or No. 9 grenades rather than improvised Jam-Tins which, if Jackson's account is correct, must have come later.

The Hairbrush grenade was an oddity. Not only did it look even less like a bomb than the Jam-Tin but it was extremely heavy, weighing in at around 3 lb. Its crude appearance was no reflection on its effectiveness, however, although its weight meant that it could not be thrown as far as the lighter grenades. Also known as the Box Pattern, it was introduced as the No. 12 hand grenade at the same time as the Jam-Tin bombs in the spring of 1915. It resembled a woman's hairbrush because of its bat-shaped wooden paddle. A rectangular tin box was attached to the broad portion of the paddle by two heavy-gauge wire clamps that passed through it to be



The Hairbrush grenade, one of Colonel Louis Jackson's designs, illustrated in The Training and Employment Grenadiers.



A French variation on the Hairbrush, an officially sanctioned improvisation made locally, known as a 'petard'. This one had a jam-tin body that was fixed to the wooden bat with nails and wire. Another variation had a rectangular tin box instead of the jam tin. In both cases, the container was not attached to the handle until the grenade was required for use. They needed to be handled with care. (The Training and Employment of Grenadiers)

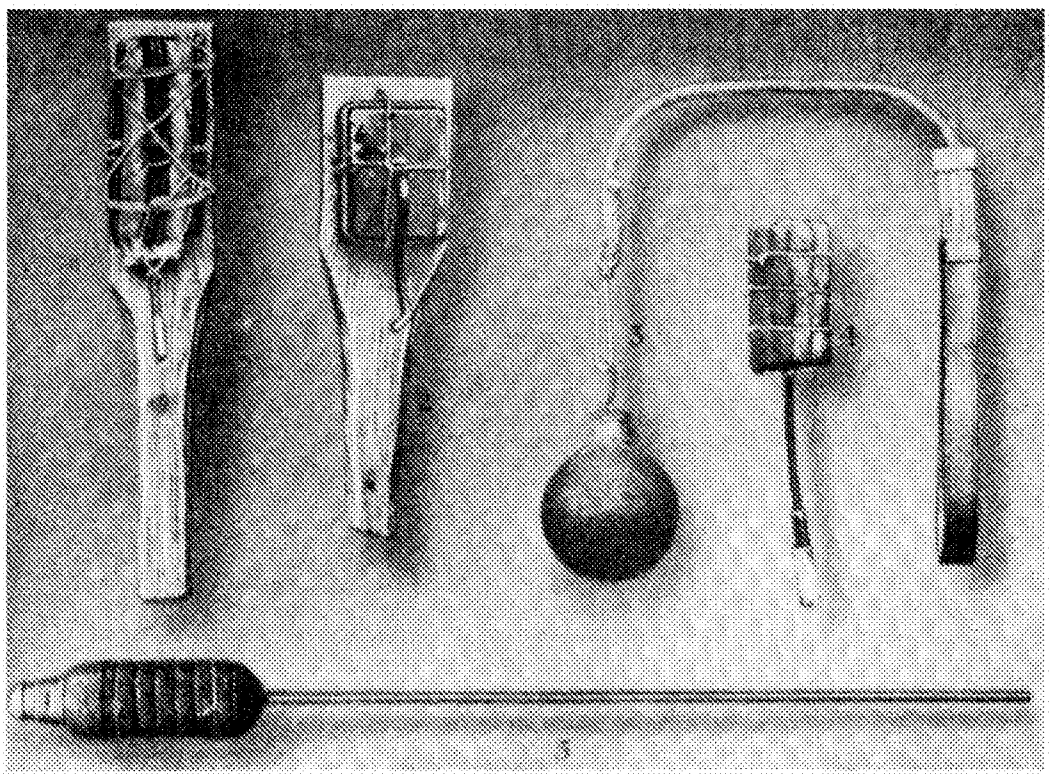
A posed demonstration of how to throw the French version of the Hairbrush – and not very far by the look of it. Note how the grenades are held on a string over his shoulder. (ILN)

secured on the reverse by nuts. The top and bottom of the box were made of steel plates into which vertical and horizontal grooves had been cut to weaken them so they would fragment into evenly sized pieces on detonation (research since the Second World War has shown that putting such grooves into the body of a grenade has little effect on the size, shape or number of the fragments). Inside this box was another smaller one for the explosive. That the box within a box of the Hairbrush was similar to the double cylinder principal of the Jam-Tin is not surprising considering that they were designed by the same man at the same time and for the same reason, namely expediency.

This grenade also took the No. 8 Mk VII detonator, which (as with the Jam-Tin) was secured in place by copper wires. However, unlike the Jam-Tin, the safety fuse was ignited by the 'igniter, safety fuze, percussion' that consisted of a brass tube, containing a striker inside a compressed spring which was held above a percussion cap by a removable pin, and a shorter, narrower brass tube into which the safety fuse was fitted so that when the cap was struck it would ignite the fuse. This form of igniter was a copy of the sort used by the Germans on their grenades. It was more reliable than match-headed fuses or lighted cigarettes because it was less susceptible to deterioration by moisture. The igniter was secured to the handle of the paddle by a metal bracket.

Like the Jam-Tin, the Hairbrush was improvised at the front, using slabs of gun cotton as explosive and it seems that the extemporized Hairbrush was not confined to the British. The German version of the Hairbrush was probably what Edmund Blunden meant when he referred to '"windy bombs" with their bat-handles'. *The Times History of the War* (hereafter referred to as *The Times History*) recorded that 'The British, French, and Germans used the "fives-bat" form . . . which consists of a cake of explosive, to which is attached a fuse ignited just before it is thrown'. Grenades were used in such large numbers by both sides that approved supplies dried up at times leaving improvisation the only recourse to remedy the situation. Such grenades might be made from virtually anything that came to hand. There were reports of bottles being filled with explosive, stoppered with a rubber plug through which a length of safety fuse was inserted. According to *The Times History* 'All sorts of contrivances were at first used to form improvised grenades. . . . Meat tins, mess-tins, and, in fact, anything that would hold a charge'.

Generally, these improvisations were made by Royal Engineers but because they were not made under the same strict manufacturing conditions as were imposed on the contractors in

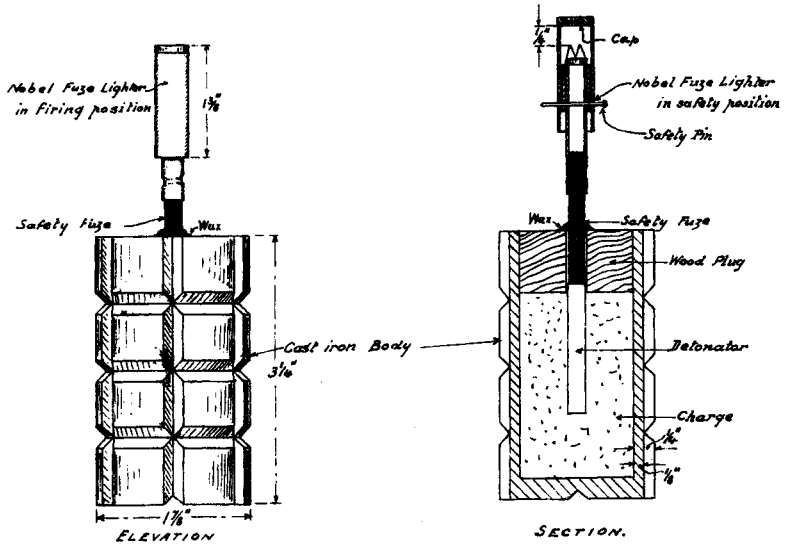


A selection of grenades, 1915. The two on the left are improvised copies of the Hairbrush; the larger one is French, the smaller one is German. The ball is a French bracelet grenade. The right-hand grenade is an improvised British device with a twist friction igniter. The rifle grenade at the bottom is German. (The Times History of the War)

Britain, there was plenty of scope for error. Many of the improvisations were more lethal to their users than the enemy as they had an alarming tendency to explode prematurely or for the resulting explosion to be excessively large. Some simply did not detonate, while on others the fuse went out before they were thrown. If a partly burned fuse was relit, there was a very strong likelihood that the grenade would explode too close to the thrower. *The Times History* recounted such an incident at the Dardanelles in which the thrower relit a Jam-Tin grenade that quickly exploded and severely injured him.

Another improvisation was the Battye bomb, made in Béthune. It is not clear whether this was made by Royal Engineers or a French firm but the evidence suggests the latter. Judging from its name, the inventor was someone called Battye. It must have been made in reasonably large numbers as the Trench Warfare Department was asked to look into the possibility of supplying different igniters for the Bickford safety fuse. The suggestion appears to have been initially turned down as impractical but Nobel igniters were subsequently fitted.

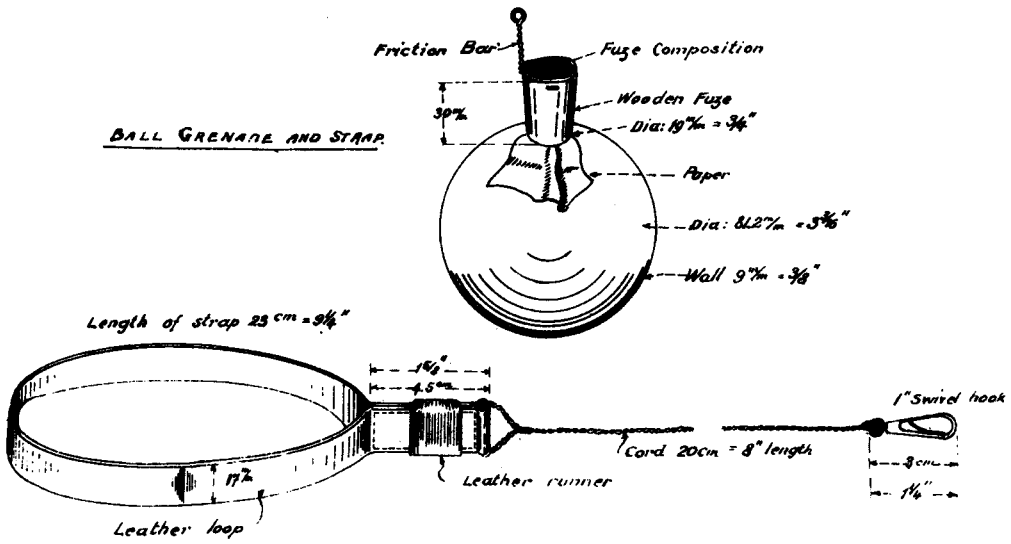
In December 1915 the use of any improvised or unapproved grenade was forbidden because of the high number of accidents. No doubt this was greeted with some relief by all concerned. Fortunately, by then the supply of grenades of an approved pattern had greatly improved. The pattern in question was the No. 5, the first version of the Mills bomb.



The Battye bomb, an interim measure of 1915, consisted of a grooved, cast iron cylinder, containing 1.5 oz of explosive and weighed 1 lb 2 oz. The detonator was only inserted immediately prior to use. The wax was to keep out moisture. (From The Training and Employment of Grenadiers, issued in October 1915)

Another posed demonstration, this time of throwing the bracelet grenade. His grenades are in the satchel. Inset left is a disassembled German rifle grenade. (ILN)

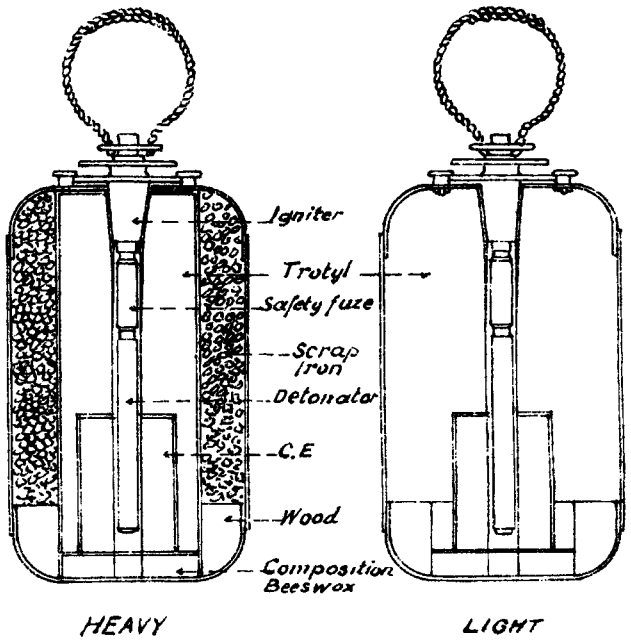
Although this was introduced in about May 1915, it did not entirely replace the other patterns until about December or even the spring of 1916. The Mills was, of course, one of the twelve to which James Jack had referred, another two of which were the No. 1 and No. 2 percussion grenades; the Jam-Tins and Hairbrush were three more. Although none of these was intended to remain in service for long – they were only stopgap measures until research came up with the elusive perfect grenade – the other six were quite different from these and included the Lemon grenades, the Pitcher grenades and the Ball and Oval patterns. They were all introduced in the first half of 1915. The Pitchers gained a reputation for lethal unsafeness, earning the bombers who used them the unenviable nickname of the Suicide Club, and the Ball and Oval patterns were so unreliable that they nearly caused disaster at Loos and were no sooner issued than they were withdrawn.



The French bracelet or ball grenade, also known as the Fortress Artillery Grenade. It was filled with black powder and ignited by friction. The strap was worn on the right wrist and paper covering the wooden plug or fuse was torn back to the body of the grenade. The wire was bent upwards and the swivel hook of the strap was clipped to the ring in the wire. The grenade was held with the fuse to the rear and thrown with the arm fully straightened until the friction bar or wire had been pulled. Extreme caution had to be exercised when straightening the wire to avoid premature ignition. (The Training and Employment of Grenadiers)

Of these, excepting the Mills, the No. 6 and No. 7 Lemon friction patterns were perhaps some of the more reliable grenades but were not without their problems. Made at Woolwich, they had been designed by the Royal Laboratory as temporary expedients like the Jam-Tin and the Hairbrush. Unlike the other grenades, they had a friction igniter that had been specially designed by the Royal Laboratory. The name 'lemon' was derived from their shape, although they did not look at all like lemons. Approximately 4 inches tall and 2.3 inches in diameter, both the No. 6 and the No. 7 had outer cylindrical casings of soldered tin, the top and bottom caps of which were shallow flattened domes so that the grenades looked rather more like modern soft drink cans than lemons. The Light Pattern, the No. 6, contained only explosive whereas the Heavy Pattern, the No. 7, had an inner casing for the explosive and the space between the inner and outer casings was filled with steel scrap as rudimentary but functional shrapnel. However, the Light Pattern was preferred over the Heavy Pattern because it could be thrown further and a bomber could carry more of them.

This reasoning was always used whenever there was a choice between light and heavy versions of grenades. However, there was a little more to it than that. Grenades that contained no added shrapnel were not only lighter but safer to the thrower and his companions, especially if the casing was soldered tin, since the grenade's effect was achieved almost exclusively by blast. Consequently, there was little risk of getting hit by shrapnel from a friendly bomb. On the other hand, a shrapnel grenade tended to hurl large pieces of metal over a greater distance than it could be thrown. If it was used in the open, the thrower and his companions were forced to take cover to avoid injury.



Nos 6 and 7 Lemon grenades. Immediately prior to use, the igniter was inserted and the flange clipped under the studs. The papier maché transit cap was then replaced until the grenadier was ready to ignite the grenade. To throw it, the grenade was held with the loop towards the wrist, the cap was removed and the loop was pulled out sharply according to The Training and Employment of Grenadiers *issued in October 1915. However, in practice this did not always work.*

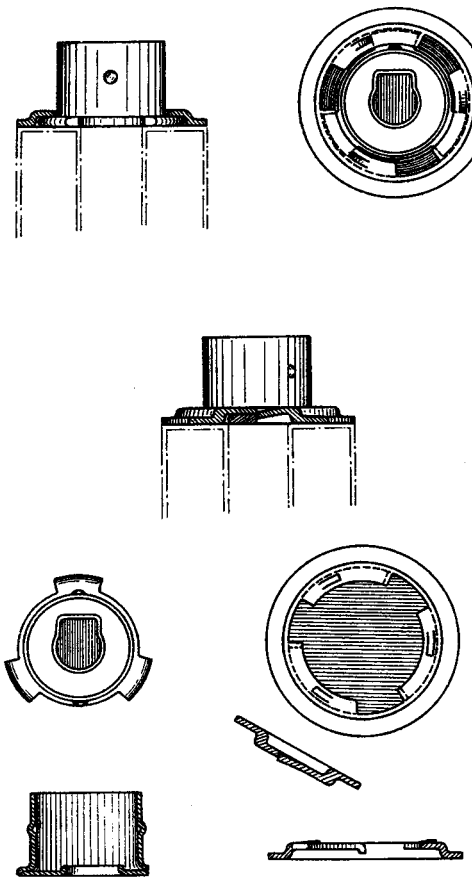
Two studs on the upper cap of the casing of the Lemon engaged a notched flange with springs on the friction igniter to hold the latter in place, rather than the cruder copper wires used on the Jam-Tin for the similar purpose of securing the detonator (a method that was almost guaranteed to result in a high proportion of failures due to the wires being inadequately tied so that the detonator fell out). This same igniter had been proposed as a modification to the Battye bomb but because a flange with studs capable of withstanding a 30 lb pull needed to be fitted to the Battye in order to accommodate the igniter, the proposal was dropped. The igniter consisted of a metal holder with a friction bar and an ignition composition inside attached to a No. 8 Mk VII detonator via a short length of safety fuse. The composition was secret and this caused some difficulties when the Ordnance Factories tried to get the grenades made by the trade because they were not at liberty to divulge its make-up, although Jarman & Co and Ewart & Son did make some of the outer casings under contract. Moreover, the friction igniters were rather too sensitive for rough treatment in the field. When fitted in the grenades, the igniters made them almost as dangerous to handle as the percussion patterns. A sharp blow to an armed grenade could fire the igniter and there was only a 5-second delay before it exploded.

In theory, the igniter was fired by a sharp pull on a loop of tarred whipcord attached to a knob fitted to the end of the friction bar. However, a letter dated 20 May 1915 from Lieutenant-General R.C. Maxwell, writing to the War Office on behalf of Sir John French, pointed out that the pull on the loop was often too much for one man and sometimes needed

Bombing practice at a Bombing School, c. 1915. (ILN)

the strength of two to make it work, hardly a recommendation for the grenade. The most effective method of firing it was to hold the grenade between the knees to pull the cord as though drawing a cork from a bottle but this often resulted in cut fingers. The problem was not encountered with all Lemon grenades, which served only to make it all the more frustrating because it only became apparent when a bomber came to use one. This was a far from satisfactory state of affairs and it needed to be put right, but it never was. The Lemon grenades were declared obsolescent at the end of December 1915.

Problems with friction igniters were by no means confined to the Lemon grenades. Far more serious difficulties were found with the so-called Pitcher grenades, difficulties that resulted in a lot of accidents, which were often fatal. The Pitcher was a commercially designed grenade and although it is not clear how it came to be adopted by the Army, it is likely that it was one of the inventions put before one of the committees or departments set up to examine ideas from the public. It has been suggested that the name 'pitcher' was derived from its



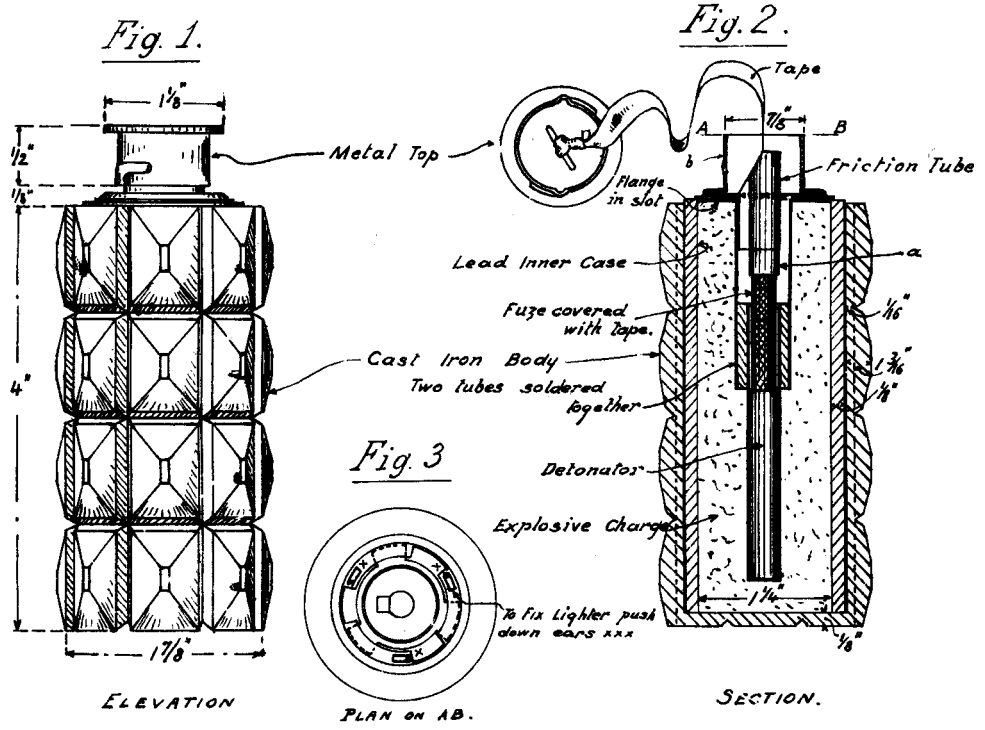
The drawings from one of Charles Sangster's Pitcher patents (5,901/15). These show 'means for connecting and locking the fuse-cap . . . to the charge-container'.

appearance. However, it seems more likely that the name was picked up from the wording in the two UK patents, 5900/15 and 5901/15, the statements of invention of which start 'This invention has reference to military hand or pitcher grenades'. 'Pitcher' clearly refers to the method of throwing grenades rather than the appearance of these particular patterns.

The Pitcher was the invention of Charles Thomas Brock Sangster, a Birmingham engineer. He applied for his two patents on 20 April 1915, predating their official introduction by only a matter of weeks. This raises the question of whether the grenade was entirely his idea or the result of collaboration with someone else. The method of making the outer casing and the shape of its segments (the subject of 5900/15) and the method of attaching the friction igniter to the casing (the subject of 5901/15) may have been refinements of something that was already under development. Unfortunately, the patents give no clue since arguments for either position can be made from the information they contain. There is a slight twist to this. Colonel Jackson claims that he designed the friction pull pattern of fuse on the Pitcher grenade, a claim that predates its introduction (in other words, it was not a modification at a later stage). It would appear that the Pitcher was a collaborative effort between Jackson and Sangster.

The two versions of the Pitcher were about the same size and weight as the Lemons, the No. 14 Pitcher being slightly heavier than the No. 13. The reason for the difference in weight was that the outer casing of the No. 13 was made of steel while that of its sister was made from cast iron. The significance of using steel for one and cast iron for the other was not made clear. Each had an internal tin cylinder filled with explosive, the space between the inner and outer casings being filled with lead wool in the case of the No. 13 and pitch in the case of the No. 14. Again it is not clear why one used lead wool and the other used pitch. Certainly, neither would have added to the fragmentation effect.

Even fragmentation of the outer casing was at the heart of Sangster's first patent. It was also his intention to 'provide an improved grenade-shell which can be more cheaply manufactured and assembled with the charge container without involving any machining operations'. The casing was cast with one enclosed end, the 'thinning grooves along and around the exterior . . . being produced or formed in the walls in or by the casting process so that all machining operations are obviated'. An essential feature of the casing was the shape of the segments. These were pyramidal with a thickened middle section, the idea being that these would cause more serious injuries by virtue of being heavier than similarly sized fragments that were of uniform thickness. Moreover, by dividing the casing into pyramidal



The infamous Pitcher invented by Charles Sangster. According to The Training and Employment of Grenadiers, *it was quite a rigmarole to assemble and arm it. The instructions and precautions described in the manual were intended to avoid more of the fatal accidents that had already occurred with the grenade. However, it had built-in dangers, including the cap – the parts marked with Xs (Fig. 3) needed to be firmly pushed down to avoid pulling out the lighter.*

segments, the theory was that fewer small and relatively harmless fragments would be produced on detonation. The War Office fondly believed that thirty-five fragments would be the result but as mentioned above, segmenting grenade casings in this way had no effect on the number or size of the fragments that were produced on detonation.

On the face of it, the Pitchers looked to be serviceable grenades that would perform under most trench conditions. But the friction fuse was frighteningly dangerous. In fairness to Colonel Jackson, this does not appear to be a design fault but rather a manufacturing one, caused to a large extent by poorly controlled production methods. The main contractors, Roburite & Ammonal, which made the No. 13, and Decimals Ltd, which made the No. 14, may not have had pressure put on them to conform to the strict manufacturing codes because of the increasingly difficult job of policing commercial businesses involved in war work. Altogether only about 10,000 No. 13s and 20,000 No. 14s were produced.

The friction igniter was basically a tube with a piece of safety fuse and a bead of a matchhead composition at the top. A piece of silk tape covered with the abrasive composition used on the outside of matchboxes was located in a groove that ran up the side of the tube, past the matchhead composition, and was tied to the igniter's removable cap. The igniter was supposed to work by pulling off the cap with a slight turn and a sharp jerk, thereby causing the tape to rub against the matchhead composition to produce a flame and light the fuse, much like striking a match on a matchbox. It sounded good.

By September 1915 Field Marshal French was demanding that the supply of Pitchers be stopped immediately because of the number of accidents with them. On 8 September 1915 Lieutenant-General Maxwell wrote to the War Office on French's instructions to describe the defects of the Pitcher grenades, most of which related to the friction igniter. He cited, as an example, an accident in August when a grenade had exploded as soon as the tape was pulled – there should have been a 5-second delay – killing the unfortunate bomber. Maxwell pointed out that the officers on the spot had determined that the accident was not because of a faulty grenade, although quite how this could have been determined after the grenade had exploded is hard to imagine. It was probably caused by a spark bypassing the safety fuse and jumping directly onto the detonator although a tape binding was already supplied to prevent this very thing happening. It was suggested that the tape may have worked loose. This was not an isolated incident; there had been many similar accidents. A court of inquiry held on 4 July into a death caused by an accident with a Pitcher made it plain that these grenades were too dangerous and that they should be withdrawn from service.

Another serious defect was the amount of pull on the tape that was necessary to make the igniter work. The tape sometimes broke without igniting the detonator because of the excessively strong pull that was needed. The tin cylinder containing the explosive, inside which was the detonator to which the igniter was attached, was sometimes so insecurely fixed to the outer casing that it was tugged out when the tape was pulled, a rather alarming, not to say dangerous, occurrence. Worse still, the flame from the igniter was found to vary from 2 to as much as 6 inches in length; 6 inches was far too powerful and tended to burn the bomber's fingers and made the grenades quite unsuitable for night work. Maxwell made it clear that because of these defects the troops in 1st Division had been instructed by their commander to light the fuse with a fusee instead.

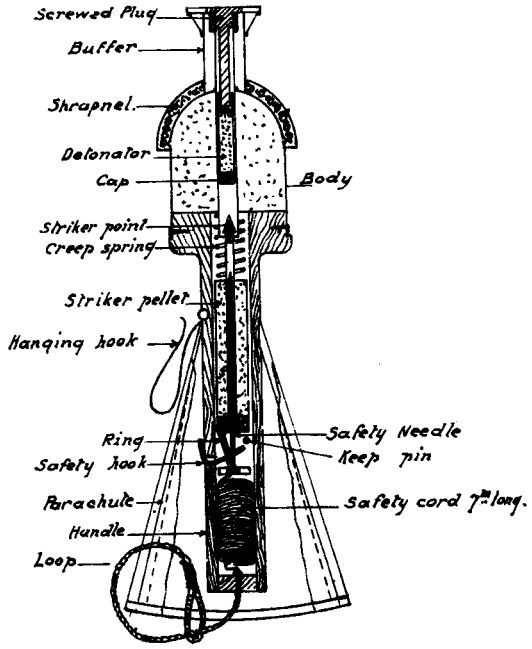
And if all that was not bad enough, Maxwell informed the War Office that Pitchers produced large fragments that flew back into friendly troops; there was a danger zone of about 200 yd and they were therefore unsuitable for throwing in the open. The brigades were told not to use the grenades any more. By the middle of September the issue of Pitchers from Britain had been stopped.

French grenadiers, c. July 1915. Yet another posed picture. Note that these French stick grenades are suspended from the belt by hooks. (ILN)

These French soldiers (from summer 1915) carry two sorts of grenade: stick grenades with lever/striker mechanisms, suspended from their belts; and the man on the right is holding a ball grenade in each hand. All three wear steel caps that go under the kepi; two wear Daigre body shields. The man on the right also carries what appears to be a short sword with a single-edged blade. The man on the left is wearing a simple gas mask. (ILN)

Writing to the War Office in June 1915, Sir John French went to some pains to reiterate his request for greater numbers of hand grenades to be supplied to the BEF. Trench fighting had created a greater demand than supplies could satisfy because men were relying more and more on the grenade. They found that the rifle and bayonet were not easy to use effectively in the confined spaces of the trenches and the only alternative was the hand grenade. Moreover, attack and counter-attack by parties of bombers meant that grenades were consumed in enormous quantities. French cited as an example a French Army corps that had got through 30,000 grenades in 24 hours at Arras. That he did not cite an example from his own army suggests that he did not know the figures, a rather curious state of affairs. He also wanted all infantrymen to be trained as bombers. Many who were untrained in the specialization of bombing were resorting to the bomb. He asked for the standardization of grenades because men were being trained in one type, only to be supplied with another.

It was a forlorn request. In June 1915 there were simply no facilities to produce one type of grenade in sufficiently large numbers to satisfy the demand. Moreover, this was still a period of 'suck it and see'; no one was certain which grenade would ultimately become the standard pattern – if, indeed, any of those currently in production and being supplied to the BEF was suitable. All of them had drawbacks.

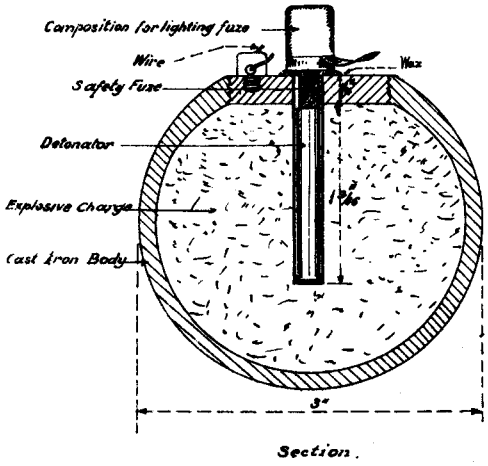


German parachute grenade. Compare this with the grenades carried by the French soldier in the photograph on the previous page. In The Training and Employment of Grenadiers *it is described as German but the photograph clearly shows French poilus. However, captured equipment was utilized by both sides. The black-painted, tin body had a cone of shrapnel. The buffer ensured that the grenade exploded above ground and the parachute made sure that it landed head first – it was a percussion grenade. The 12–13 ft safety cord inside the handle was attached to a safety needle and the loop was held in the hand when the grenade was thrown upwards. When it reached a height of about 12–13 ft, the needle was jerked out freeing the safety hook, which fell away and released the ring that was attached to the striker pellet thus arming the grenade.*

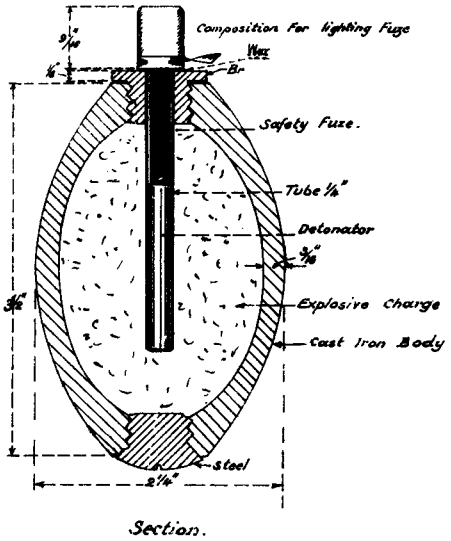
In August Maxwell wrote to the War Office with the estimated daily expenditure of grenades. According to him it was 220 rifle grenades, 120 percussion grenades and 240 time-fused grenades for each division. As there were forty-eight fighting divisions in the BEF at this time, this came to a daily expenditure of 17,280 grenades of all types and 10,560 rifle grenades. In addition, he wanted reserves per division of 4,500 rifle grenades, 7,000 percussion grenades and 7,000 time-fused grenades. These figures did not take into account the daily requirement of twenty grenades per bomb-thrower and catapult, which for each division evidently amounted to 160 grenades for the West Spring Gun and 160 for the Leach catapult. According to Maxwell, this came to 7,500 of each per day but this would only supply forty-seven divisions not forty-eight. Interestingly, these figures indicate that there were on average eight West Spring Guns and eight Leach catapults in each division.

In September 1915 French launched the BEF into the Loos offensive. The No. 15 Ball Pattern or Cricket Ball grenade was intended to play an important role in this attempt to breach the German defences and break through to open country beyond. In the event, not only was the offensive unsuccessful but the failure of the grenade nearly led to disaster. 'A number of regiments were supplied with the "Cricket Ball" Grenade. . . . Owing to the rain, in about 18 out of every 20, the igniter failed to light' was how the débâcle was described in 1919. The Ball grenade had originally been designed to meet an urgent request for bombs in the Dardanelles, where there was a severe grenade shortage. Its design was influenced by the need for fast production and it fulfilled its purpose admirably. In early September the rate of production was more than 200,000 a week.

The No. 15 was a 3 in diameter sphere of cast iron, segmented internally for fragmentation. It had either a 5-second or a 9-second fuse, the latter being intended for use with catapults and bomb-throwers with which it was considered to be very useful. Both used a Brock matchhead igniter that was struck against an arm brassard to light it and both had a lead pull-off cap to protect the fuse prior to use. In the Dardanelles, where the weather was hot and dry, the grenade fulfilled its expectations, which no doubt led the Home Authorities



The infamous No. 15 Ball grenade that failed so abysmally at Loos in September 1915. (The Training and Employment of Grenadiers)



The No. 16 Oval grenade fitted with a Brock lighter. 'The lighter consists of a small cardboard cup filled with friction composition, covered with waterproof paper.' The small tag on the right is used to pull off the cover. An armlet was used to light the fuse. (The Training and Employment of Grenadiers)

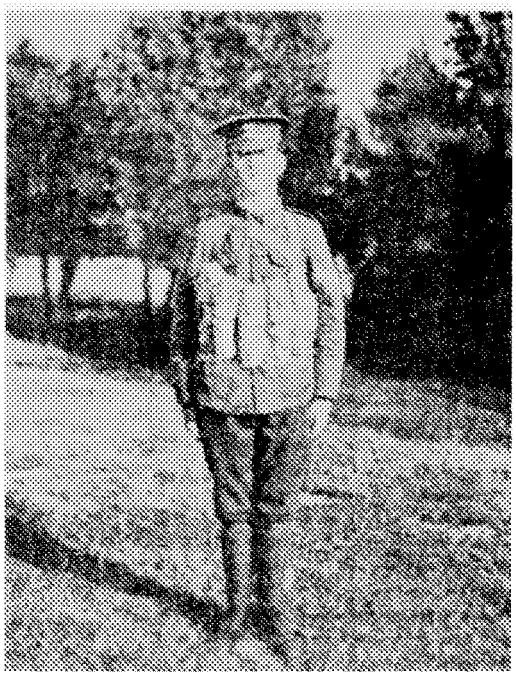
to believe that it would perform equally well in France. Its only drawbacks were the size of the explosive charge and its 3 in diameter, both of which were considered to be too big. The solution to the size problem was the No. 16 Oval Pattern, which was essentially the same as the Ball differing only in shape, although the Oval Pattern had a brass plug in the base to close the charge-filling hole. The Oval was supposed to replace the Ball around September but because the ignition system was same for both grenades, the Oval suffered from the same problems as its sister in wet weather.

A memo from Louis Jackson in mid-September 1915 explained that the problem of the excess charge had been addressed by replacing some of the explosive with sand. This modification had evidently been undertaken before September because Lieutenant-General Maxwell noted the increased lethality of the Ball grenade if only half the ammonal charge was used (about 2.5–3 oz) in a letter to the War Office at the beginning of the month. The effect of this was to increase the size of the fragments.

Significantly, in view of what was about to happen at Loos, Maxwell also noted the inferiority of the Ball (along with the Lemon patterns) compared to the Mills and expressed the hope that the supply would soon discontinue. The Mills, however, although being produced at the rate of 33,000 a week, was not being delivered effectively. Only 10 per cent of the Mills that should have been delivered by the beginning of September had arrived. So Maxwell and French were stuck with the Ball pattern, like it or not.

The 2nd Battalion, Royal Welch Fusiliers was one of the regiments supplied with the Ball grenade at Loos. Captain Dunn recorded that they were equipped with 'several new and unwieldy bombs known as "cricket balls". The match-striker on which the bomb fuse had to be lighted had become so wet as to be useless.' Robert Graves recalled that survivors of the two leading

Stick grenade carrier, October 1915, as illustrated in CDS 74 The Training and Employment of Grenadiers. *It consisted of a belt 3 ft long and 3 in wide tied at the back with tapes, with supporting straps over the shoulders. There were eight loops for grenades.*



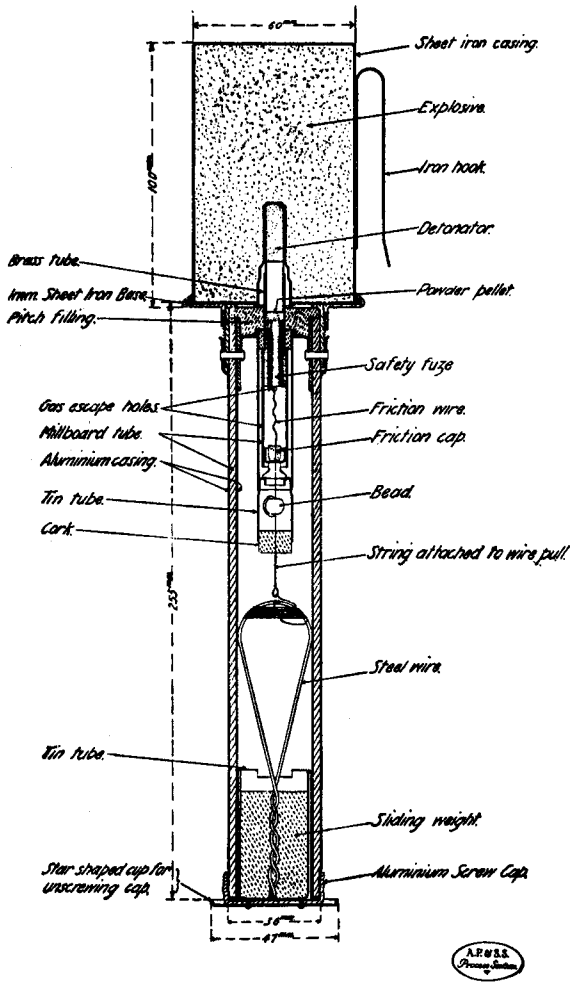
The waistcoat designed for the Nos 6 and 7 grenades was intended to hold ten bombs. The waistcoats were packed in the grenade boxes used to transport the grenades to the Front. (The Training and Employment of Grenadiers)

Two slightly different patterns of waistcoat worn in summer 1915 for carrying grenades. The men appear to holding Ball grenades. (The Times History of the War)

companies of the neighbouring Middlesex Regiment sheltering in shell holes near the German wire 'had bombs to throw, but these were nearly all of a new type issued for the battle. The fuses were lighted on the match-box principle, and the rain had made them useless.' Jack recorded, of a diversionary attack at the same time, that 'the fuses of the bombs became damp from rain and would not light'.

On 20 November 1915 the Army Council made it clear that the only time-fused type of grenade it wanted was the Mills No. 5 and that the Ball Pattern should be discarded forthwith because it had shown itself to be quite useless. Not surprisingly, the men had lost confidence in it, although it is doubtful that there was ever any confidence to lose. The Army Council proposed that the entire stock should be returned to Britain unless a damp-proof ignition system could be supplied very quickly. Such a system was not a feasible option and on 25 November all outstanding contracts for the No. 6, Ball and Pitcher grenades were cancelled. The year 1915 had not been a good one.

Nearly twelve months later, by which time Loos had been over-shadowed by the Somme, Edmund Blunden came upon a mildewed old store of Cricket Balls and Hairbrushes that had lain untouched and long forgotten. Wisely, he decided to leave them alone.



Drawing of a 1917 German stick grenade from SS 566 showing its mechanism. The screw cap at the base of the handle is removed and the weight falls, pulling the wire and operating the friction igniter. Armed by the act of throwing. (MUN 4/3589)